

THE INFLUENCE OF WAR ON DISEASE.

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It is obvious that the altered conditions of life during war must influence the health of the Navy and Army. On the improvement of physique and health of recruits from towns, as the result of training in fresh air and sunshine, and on the practical absence of venereal disease in the isolated fleet, it is unnecessary to insist. But we must gratefully note that, as a result of the labours of those responsible for the sanitation of our defenders, the health of the Navy and of the Army has, with the exception of those in the Dardanelles, been remarkably good. The health of the regular Navy has indeed been much better than in peace time.

In the Grand Fleet, the percentage of men on the sick list is under 1 per cent., often only 0·6 per cent., and the figures would be even lower but for the higher percentage incidence among the men of the Royal Naval Reserve and the Royal Naval Volunteer Reserve. On two battleships with a complement of over 1,000 each, which I happened to visit on two successive days, there were two men only in the sick-bay. With the progress of this greatest of wars, evidence is gradually accumulating as to the modifications thus induced in medicine and surgery, and upon these it may be appropriate to offer a few general remarks, and then to refer specially to some of the morbid conditions which have been prominent since August, 1914.

GENERAL REMARKS.

War, by massing together in close quarters large numbers of men, and especially of young recruits, facilitates the spread of infection, and thus fevers which, in peace, are endemic or sporadic become epidemic; this has been the universal experience, and was shown in the case of typhoid fever in the South African War, of typhus in Serbia, and of paratyphoid

and, to a lesser extent, of cerebro-spinal fever among our own men during the present campaign. In war, the existence of healthy carriers of disease becomes a factor of great importance, especially in stationary conditions such as the trenches. Now that the hygienic arrangements of armies in the field have been so perfected, the carrier problem probably plays a much more prominent part than in the past. In France and Belgium, there was no explosive epidemic of enteric fever, such as would occur if the infection was water-borne, so that carriers appeared to be the cause of the outbreak (Leishman¹). The qualification implied by the word "probably" is, perhaps, necessary, for the existence of healthy carriers of disease has been generally recognized for a few years only.

By exposing large numbers of men to adverse conditions, the exigencies of war also lead to outbreaks of other morbid conditions which, in normal circumstances, occur sporadically or accidentally. This is seen in the so-called trench diseases—acute nephritis, the much-discussed nutritional change in the feet, gas gangrene, and tetanus (231, with a mortality of 57·7 per cent. (Bruce)), and "trench-fever"—some of which, however, are by no means confined to the trenches. The special form of acute lung disease—acute bronchitis and broncho-pneumonia—due to the employment of poisonous gases (chlorine, bromine) by the Germans, has, to the credit of nations, never been experienced in war before, but it is not absolutely unknown in peace as the result of accidents. The nervous strain of war would naturally be expected to produce much insanity, mental disturbance, and neurasthenia. My impression is that, in the Navy at least, this anticipation has not been fully realized, and, in a recent paper giving the experience on board a battleship, Beaton² found that mental troubles of a really serious nature occurred in less than 1 per cent., and mild neurasthenic conditions in less than 4 per cent. Quite possibly this is due to the absence of alcoholism among the seamen, for, in the Fleet, the allowance of stimulant is only half a gill of rum daily, and special precautions are taken to prevent the men having more. The conditions in the Fleet during war necessarily interfere with ventilation at night, and a considerable increase in the amount of pulmonary tuberculosis might natur-

ally be expected. Here I cannot give figures, but my impression is that this is not the case. The men are carefully watched, and any suspected case of tuberculosis is at once removed from the ship. The effect of defeat and of captivity, even when not accompanied by privation, is to render soldiers more susceptible to disease. The great epidemic of typhus in Serbia appears to have begun among Austrian prisoners, though here the sanitary conditions, or rather their absence, probably played a prominent part.

War, by altering their circumstances, may cause disease among the non-combatants, even of an uninvaded country, in many ways—by deterioration in the quantity and quality of food, by mental strain and depression, and by altered occupation. To illustrate the last factor first, the large numbers of men and women working in war factories are exposed to new and, in some instances, injurious influences. Thus, as the result of exposure to the fumes of tetrachlor-ethane, which is used for painting the wings of aeroplanes (and, incidentally, for dry cleaning and the destruction of vermin in Army laundries), an outbreak of toxic jaundice of a new type among aeroplane workers has been described.³ In the siege of Paris, it was noted that exophthalmic goitre became more frequent, and it seemed to me that this was also true after the Boer War. Both in the Boer War and this campaign, isolated cases in combatants have come under my observation. It would also be interesting to know if there has been an increase in the incidence of diabetes.

The surgery of war differs from that of peace. In ordinary circumstances it is the surgeon who makes most of the wounds and takes every precaution that they shall be aseptic, whereas, in war, his main duty is to deal with wounds already infected. In war, the surgeon's work is largely, as it was in the rather distant past, concerned with remedying the results of external injury, and much less in combating the ravages of internal disease. Until the war, amputations were comparatively rare; since its onset, they have been too often necessary. The prevalence of infected wounds is creating a literature of its own, which deals with the methods of antisepsis, or, in other words, shows that war surgery is antiseptic or "back to Lister," as Sir Rickman Godlee entitled his lecture at the Royal Institution, in contra-

distinction to the aseptic surgery of peace. With this has followed the discussion of new antiseptic applications—"borsal," hypochlorite of sodium ("Eusol" and "Eupad")—and of Wright's physiological drainage. The frequency with which shell and bullet wounds pick out parts of the body which are comparatively seldom selected by uncomplicated disease, is leading to the accumulation of special knowledge, which is facilitated by the assistance of the Medical Research Committee of the National Health Insurance. Thus, Gordon Holmes and Sargent have analysed their cases of injury to the longitudinal sinus in the skull, and discussions have been held on gunshot wounds of the head and of the peripheral nerves. The remarkable effects of shell shock, without gross lesion of the spinal cord, attracted attention early in the war (Elliott, Aldren Turner). Gordon Holmes gave the Goulstonian Lectures on spinal injuries of warfare, and "the functional neuroses caused by shell fire without visible sign of injury" is the subject for a special discussion at the Neurological Section of the Royal Society of Medicine. Arterio-venous aneurysm and hæmothorax are almost curiosities in peace, but are comparatively common in war.

It is interesting to compare the present war with that in South Africa. There is a marked contrast between the conditions on the Western line in France and Belgium, where, thanks to the admirable hygienic arrangements of the R.A.M.C. and the prophylactic anti-typhoid inoculation, the incidence of typhoid fever was insignificant in comparison with the casualties directly due to bullets and shells, and those in South Africa, where typhoid fever was endemic. But, as will be shown later, paratyphoid fever, against which there was little protective inoculation, has usurped the place ordinarily taken in war by typhoid. Wounds in France and Belgium become severely infected from the state of the soil, and gas gangrene and tetanus have been prominent; on the other hand, the conditions, as regards wounds, were remarkably favourable on the sunburnt veld of South Africa, where the antiseptic system, on a large scale, was employed for the first time in civilized warfare, but where, as the late Mr. Clinton Dent epigrammatically remarked, "the climate did more than the carbolic acid."⁴ Veld sores, however, which were probably due to coccal infection, were

common in the Boer War, and have not, so far as I know, their equivalent in Flanders. In the Dardanelles campaign, however, as has always been the experience in war until quite recently, disease due to infection through the alimentary canal—typhoid, paratyphoid, dysentery, diarrhœa, and jaundice—assumed grave proportions. Up to October, 1915, there were 78,200 medical invalidings from the Gallipoli peninsula, and diarrhœa was, as in South Africa, extremely common after landing. In South Africa, acute nephritis was very rare and “rheumatism” common, whereas in France the reverse holds good.

Enteric Fever.—In the nomenclature of disease, it is convenient to use “Enteric Fever” as a general clinical heading, and to include under it typhoid and paratyphoid fever A. and B. In this country, paratyphoid B. is the form met with, whereas paratyphoid A. is that seen in India, where the disease has been extensively studied by the medical staff of our Army. In 1912, Boycott estimated that three per cent. of the cases in this country regarded as typhoid were really paratyphoid B. As enteric fever has, of late years, become comparatively rare in this country, the existence of paratyphoid fever has not been much to the fore. The war, however, has changed this, and, both in Flanders and in the Dardanelles paratyphoid has been common. In France, both forms occur, the paratyphoid A. being probably introduced by our Indian contingent. We are indebted to Torrens and Whittington, H. Robinson, and Sir Bertrand Dawson, for analytical papers on the cases in France, and the number of men invalided from the Dardanelles, mainly with paratyphoid A. (Ledingham and Penfold), shows its frequency there.

In the Expeditionary Force on the Continent, as the result of anti-typhoid inoculation, paratyphoid fever is actually more frequent than typhoid. Thus, Sir Bertrand Dawson refers to 1,363 cases of enteric fever in France, of which 910, or 66·7 per cent., were due to paratyphoid infection. But mixed infections with *Bacillus typhosus* and paratyphoid bacilli may occur; I saw a case of this kind in England some years ago. As compared with typhoid fever, paratyphoid fever is less definite and less severe; cases are, therefore, more likely to remain latent or to be regarded as

"influenza," and so to spread the infection. It is also much less fatal; among Sir Bertrand Dawson's 910 cases, the mortality was two per cent.; Torrens and Whittington give the mortality of paratyphoid B. as a little over four per cent., and, of paratyphoid A., as under one per cent. A different estimate, however, is given in the *British Medical Journal* (1915, II., 610) as to the relative fatality of the two forms of paratyphoid fever, viz., among 368 cases of paratyphoid A., 9 deaths, or 2.4 per cent., and among 447 cases of paratyphoid B., no deaths. The two forms are so much alike that their differentiation must depend on bacteriological examination. While agreeing with this, Torrens and Whittington state that paratyphoid A. is more prone to relapse, is milder, and lasts three or four days longer than paratyphoid B. (10-18 days). From the experience of this war, it appears that intestinal lesions in paratyphoid fever are more important than was formerly believed.

The value of Sir Almroth Wright's anti-typhoid inoculation has been fully confirmed. But there is a risk that statistics compiled of all the cases of "enteric fever" may show that a considerable number of men inoculated against *B. typhosus* have gone sick of what is termed typhoid or enteric fever, but is really paratyphoid fever. Every effort is now being made to avoid this fallacy, which might throw doubt on the efficacy of anti-typhoid vaccination, and give the anti-vivisectionists cause to blaspheme. As a rule, the anti-enteric vaccination has been with a vaccine of *B. typhosus* only, though Dreyer and Ainley Walker, at Oxford, have used a triple vaccine of *B. typhosus* and *B. paratyphosus* A. and B., which had been previously employed by Castellani and by Vincent who called it, for short, T. A. B. Castellani and Mendelson⁵ have described a tetra-vaccine of typhoid, paratyphoid A. and B., and cholera, with which 170,000 Serbians have been inoculated without any untoward results. It is obvious that an inoculation with a polyvalent anti-enteric vaccine, such as has been recently employed in the Royal Navy by Fleet-Surgeon Bassett-Smith, R N., is highly desirable.

Large numbers of convalescent enteric patients are now arriving in this country, and bacteriologists are very hard at work in examining their excreta so as to prevent the escape

of carriers into the general population. It is satisfactory to learn that, by the tenth week of convalescence, not more than one per cent. of patients are still carriers of the typhoid or paratyphoid bacilli.⁶ Further, during and after the South African War, when 31,000 convalescent enterics were invalided home, there was not any epidemic outbreak of enteric fever in this country, although precautions against the carrier state were not taken. Although it would be criminal to encourage the slightest relaxation of the regulations now in force to prevent the escape of carriers into civil life, the above considerations may serve to allay any excessive anxiety as to the occurrence of typhoid and paratyphoid outbreaks in this country.

Dysentery.—The prophecy that this “war disease” would break out on the Western front has, happily, proved false. But in the Dardanelles there has been a very heavy toll among our men. Diarrhœa was extremely common among the men when first landed in Gallipoli, and came to be expected as all in the day’s work. In many cases, after a time, it passed into or was succeeded by dysentery, and then, for the first time, the men reported sick. The nature of the dysentery in the Dardanelles is an interesting question; when the patients arrive here—and fortunately the majority have become convalescent on the voyage—there has been little evidence that the disease is amoebic; whereas in the hospitals near the Dardanelles, especially in Alexandria and Cairo, the *Entamœba histolytica* is found in a large majority of the cases, and emetine is given hypodermically with gratifying success. As emetine destroys the entamœba, this may help to explain our failure to find it in the fæces. As Strong showed in the Philippines, the two forms of dysentery may occur side by side, and mixed infections are found. Difficulties also arrive in the clinical diagnosis between dysentery and enteric fever. A patient clinically the subject of dysentery may be proved bacteriologically to be suffering from enteric, and *vice versâ*; and it has been stated that every case labelled dysentery from the East should be regarded as potential paratyphoid fever (Bassett-Smith); out of 70 cases arriving at Plymouth as dysentery, 40 per cent. were paratyphoid A., 20 per cent. paratyphoid B., and 11 per cent. typhoid (Whiteside). Without bacteriological assistance, a

case of dysentery with fever may easily be regarded as enteric. It is hardly necessary to point out that a positive agglutination reaction for typhoid fever occurs in those who have been inoculated against that disease, and that, if such a patient has dysentery, reliance must be placed on bacteriological examination of the stools and not on Widal's reaction. The two diseases may be contracted at the same time, the symptoms of dysentery appearing first, and being followed by those of enteric, as I saw in South Africa; or dysentery may be a secondary infection of typhoid or paratyphoid fever.

In the treatment of the cases of dysentery arriving in this country, I have seen and tried various methods. In a few cases I have given antidysenteric serum, which has been stated to be one of the most successful serums, both hypodermically and per rectum; but probably this was not a fair test, for the men were old and the disease very severe. Sublimed sulphur (grs. v. to x.), combined with Dover's powder to prevent excessive purging, three to six times daily, as given by Richmond in South Africa, was very effective in some cases—those of a comparatively mild type—but was by no means constantly successful. Bismuth and charcoal in large doses have been tried, as have kino and salol. I have knowledge of cases which have improved after hypodermic injections of emetine, although they were not amoebic dysentery. Magnesium sulphate or sodium sulphate and washing out the bowel are probably inferior to appendicostomy, but I have not seen this operation performed during the war. For very frequent motions with tenesmus, morphine suppositories may be given. During convalescence, when constipation becomes troublesome, paraffin has appeared useful. The important question of diet I need hardly discuss; but one point as to prophylaxis is worth consideration, namely, that carriers of dysentery bacilli should logically be treated with the same stringent care as carriers of typhoid and paratyphoid bacilli. What has been said about the chances of typhoidal outbreaks after the war probably holds good, in the main, as regards dysentery; but Carver⁷ refers to some instances, both after the South African War and at the present time, of dysentery in this country probably imported from abroad, and urges that it should be a notifiable disease.

Jaundice has been very frequent among our troops in the

Mediterranean, and a large number have been invalided to England. It may follow the diarrhœa which is so prevalent there, dysentery, typhoid and paratyphoid fever. I have seen it occur in the Royal Naval Hospital, Haslar, in a typhoid carrier, and at the Osborne Convalescent Hospital for Officers after dysentery, thus suggesting that, in both instances, the infection was brought from Gallipoli and remained latent. Dr. McBean Ross writes to me from the Mediterranean Expeditionary Force that, contrary to expectation, it is rarely the sequel of diarrhœa, and far less of definite dysentery, and that it is usually mild and without much constitutional disturbance. Patients seen on their return home, however, have usually lost much weight. The only necropsy that I have seen showed severe gastro-enteritis with a plug of tenacious mucus in the orifice of the biliary papilla. It is tempting to assume that this epidemic jaundice is the same as that long known in Egypt, and is infective in origin (*Bacillus proteus*).

Cerebro-spinal Fever.—Although it has been stated that it is not a war disease (Heiman and Feldstein), cerebro-spinal fever has, since the outbreak of war, for the first time in this country, as pointed out by Sir William Osler prevailed in epidemic form. There were, in the first year of the war, over 400 deaths in the home Army, which placed the disease second on the list of the causes of death from acute infections, and 170 cases, with 90 deaths, in the Royal Navy. During 1913, the total force of the Navy was 126,830 men, and there were eight cases of the disease. The epidemic can hardly be explained, except as due to the massing of large numbers of young recruits among whom carriers existed, and the prophylaxis is, therefore, directed to improving the conditions of the recruits and combating the carrier state. The last is a difficult proposition, for carriers may be periodic or intermittent, alternately giving positive and negative results. For this reason, it would be wise to invalid out of the Services those who have recovered from the disease. Diagnosis, sometimes very easy, may be extremely difficult, and, without bacteriological assistance, meningismus, especially at the onset of pneumonia, may at first be indistinguishable. Other forms of meningitis, such as the pneumococcal variety, occurred during the epidemic. The onset of this disease may be extremely like that of influenza, and, conversely, influenzal

meningismus may imitate cerebro-spinal fever. The general mortality has been high—over 50 per cent.—and the results of the intrathecal injection of anti-meningococcal serum have generally been disappointing. Much of the serum employed in this country has been found to be inert and unsatisfactory, possibly because, from the sudden demand for it, large quantities came from America, where few horses had previously been immunized, and were therefore bled too frequently. Dr. Robb, who provided this explanation, stated that a serum, even better than the original one, is now being prepared; and Sir Arthur May, Director General of the Medical Department of the Admiralty, informs me that Dr. Simon Flexner is very kindly providing for use in the Royal Navy a serum, specially prepared under his supervision at the Rockefeller Institute.

Hæmothorax in civil practice is rare, and, when it does occur, is usually the result of some rapidly fatal lesion such as rupture of an aneurysm or very severe trauma; therefore previous experience is of little value for the frequent cases seen in war. In the Boer War, the cases were remarkable for the presence of unexplained fever, which suggested an empyema and therefore invited exploration. Makins, however, found that suppuration did not occur unless the cases were explored or operated upon. Acting on this experience, I have watched the cases at Haslar, and only advised exploration when a considerable leucocytosis was associated with a spiky temperature. There certainly were a few empyemas, but the majority of the patients have improved, though very slowly. In some cases of left-sided hæmothorax, there was a persistently rapid pulse. In the Army, the conclusions and treatment have been very different. Rose Bradford and Elliott,⁸ on analysis of 450 cases of hæmothorax, find that 25 per cent. of the cases become infected, and that 10 per cent. prove fatal. Sepsis is responsible for 70 per cent. of the deaths; simple hæmorrhage, which is not likely to prove fatal after the third day, for five per cent., and the various complications for the remainder. Infection of a hæmothorax may occur as acutely as in infective peritonitis, and is prone to result, at the time of the wound, from fouling of the skin and clothing with earth and fæcal bacteria. High-velocity bullets at short range and tearing fragments of shells produce much greater laceration than was seen in South Africa, and

the hæmothorax is often so large that it cannot be left alone. Eighty-nine cases of sterile hæmothorax were tapped, and usually three pints of blood removed; in one case only did an empyema follow. From post-mortem examinations of 69 cases of hæmothorax, it appears that the effused blood always clots rapidly. It is advised that a sterile hæmothorax, except when small, should be aspirated; and it is pointed out that signs of air as well as of blood may be due to anærobic infection, and that immediate resection is then required.

Acute Nephritis.—Some time ago, “a new disease” was rather tentatively described; but it appears to be a true acute nephritis of unknown origin, of which, according to Langdon Brown,⁹ there have been 1,062 cases in our Army in France, up to the end of June, the numbers increasing as the months got warmer. Possibly the tonsils are the entrance of the virus which is not bacterial, though a filter-passer cannot be eliminated. The urine and blood are sterile. The main clinical features are œdema, albuminuria, casts, frequently hæmaturia, shortness of breath at the onset, variability in the duration, the tendency to remission and relapse, and ultimately favourable prognosis. Of Brown’s 58 cases, one proved fatal, and of Abercrombie’s 95 cases, none.¹⁰

The so-called *Trench Fever*, an intermittent fever of as yet unknown origin,¹¹ may apparently be confused with influenza, paratyphoid fever, and dengue, but differs from them clinically and bacteriologically. Doubtless there are still several fevers of unknown origin, and it has been suggested that trench fever may be due to the bites of body parasites, and thus might be compared to rat-bite and sandfly (or phlebotomus) fevers.

REFERENCES.

- ¹ *Brit. Med. Journ.*, 1915, II., 780.
- ² *Journ. Roy. Nav. Med. Serv.*, 1915, I., 447.
- ³ *Brit. Med. Journ.*, 1914, II., 1105; and Willcox: *Trans. Med. Soc.*, London, 1915, XXXVIII, 129.
- ⁴ *Med.-Chir. Trans.*, London, 1900, LXXXIII., 301.
- ⁵ *Brit. Med. Journ.*, 1915, II., 711.
- ⁶ *Brit. Med. Journ.*, 1915, II., 687.
- ⁷ *Brit. Med. Journ.*, 1915, II., 532.
- ⁸ *Brit. Journ. Surgery*, Bristol, 1915, III., 247-260.
- ⁹ *Journ. Roy. Army Med. Corps*, 1915, XXV., 75.
- ¹⁰ *Brit. Med. Journ.*, 1915, II., 531.
- ¹¹ Hunt and Rankin, *Lancet*, 1915, II., 1133.

